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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/711,414	09/17/2004	Yun-Ren Wang	NAUP0594USA	5413
27765 7590 06/29/2007 NORTH AMERICA INTELLECTUAL PROPERTY CORPORATION P.O. BOX 506 MERRIFIELD, VA 22116			EXAMINER MILLER, MICHAEL G	
			ART UNIT 1709	PAPER NUMBER
			NOTIFICATION DATE 06/29/2007	DELIVERY MODE ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

winstonhsu.uspto@gmail.com
Patent.admin.uspto.Rcv@naipo.com
mis.ap.uspto@naipo.com.tw

Office Action Summary	Application No.		Applicant(s)	
	10/711,414		WANG ET AL.	
	Examiner		Art Unit	
	Michael G. Miller <i>MG</i>		1709	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 01 June 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-15 is/are pending in the application.
- 4a) Of the above claim(s) 10-15 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-9 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>23 FEB 2006, 30 MAR 2007</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Election/Restrictions

- 1) Applicant's election of Claims 1-9 in the reply to Examiner's restriction requirement filed on 1 Jun 2007 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).
- 2) Claims 10-15 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on 1 Jun 2007.

Claim Rejections - 35 USC § 103

- 3) The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:
 - a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.
- 4) Claims 1-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Laxman et al (U.S. Patent 5,976,991, hereinafter '991) in view of Takahashi (U.S. Patent 5,517,943, hereinafter '943) and further in view of Kaizuka et al (U.S. Patent 6,436,203, hereinafter '203).

- i) With regard to Claim 1, '991 teaches a method for depositing silicon nitride on a substrate, comprising:
 - (1) providing a chemical vapor deposition (CVD) system comprising a tubular furnace (Column 7 Lines 29-37, 58-64), at least one BTBAS (bis t-ButylaminoSilane) supply piping line (Column 7 Lines 58-64) connected to a base portion of said tubular furnace, an exhaust piping line (implicitly taught by the presence of the vacuum pump, Column 7 Lines 43-45) connected to an upper portion of said tubular furnace, a bypass line connecting said BTBAS supply piping line with said exhaust piping line (not explicitly taught), and a vacuum pump (Column 7 Lines 43-45) connected to said exhaust piping line, wherein said bypass line is initially interrupted (not explicitly taught);
 - (2) placing a batch of wafers (Column 7 Lines 47-49) into a tube of said tubular furnace (Column 7 Lines 29-30);
 - (3) flowing nitrogen-containing gas into said tube (Column 8 Lines 57-60);
 - (4) flowing BTBAS into said tube through said BTBAS supply piping line (Column 8 Lines 57-60) and said vacuum pump (Column 7 Lines 42-45) maintaining pressure in said tube in a range of between about 0.1 Torr and 3 Torr (Column 3 Lines 16-17 discuss a range of 0.02 – 760 Torr; Column 8 Lines 57-60 disclose a pressure point of 0.5 Torr);
 - (5) performing a silicon nitride deposition process in said tube to deposit a BTBAS-based silicon nitride film on said wafers (Column 8 Lines 60-63;

for silicon nitride deposition NH_3 would be the preferred if not sole nitrogen-containing gas);

(6) upon completion of said silicon nitride deposition process, interrupting said BTBAS supply piping line (see point 9 below) and opening said initially interrupted bypass line (not taught); and

(7) removing said batch of wafers (see point 9 below).

(8) '991 does not explicitly teach the vertical locations of the piping and exhaust lines, a bypass line, or that the bypass line starts out interrupted and is later opened.

(9) It would have been obvious to a person having ordinary skill in the art at the time the invention was made to interrupt the BTBAS supply line at the end of deposition, since terminating the flow of a reactant was a known way to terminate a reaction, and to remove the batch of wafers from the reactor at the end of processing, since it would have been desirable to use the reactor to coat multiple batches of wafers in its lifespan.

ii) '943 teaches an apparatus for chemical vapor deposition comprising:

(1) a tubular furnace (Item 3, Figure 1),

(2) at least one BTBAS (bis t-ButylaminoSilane) supply piping line (Items 6-8, Figure 1; taught as generic reaction gas supply lines) connected to a base portion (via Items 4a and 4b connected from Items 15a and 15b, Figure 1) of said tubular furnace,

- (3) an exhaust piping line (Item 16A, Figure 1) connected to an upper portion of said tubular furnace (via Items 4a and 4b going to Items 16a and 16b, Figure 1),
 - (4) a bypass line connecting said BTBAS supply piping line with said exhaust piping line (not explicitly taught),
 - (5) and a vacuum pump connected to said exhaust piping line (Item 19, Figure 1),
 - (6) wherein said bypass line is initially interrupted (not explicitly taught).
 - (7) '943 also teaches a 'flip-flop' gas flow pattern (Column 4 Lines 27-33, Column 5 Lines 7-16) which is advantageous for aiding the uniformity of the deposited coating.
- iii) '203 teaches a bypass mechanism (Column 4 Line 64 – Column 5 Line 65) comprising a valve (Item 26, Figure 2) for initiating and terminating the gas supply, a supply line (Item 21, Figure 2) for providing gas to the system, a switch valve (Item 28, Figure 2) for diverting flow between the chamber and the exhaust, a switch valve (Item 29, Figure 2) for controlling the flow of a purge gas, and an exhaust line (Item 36, Figure 2) to connect to the exhaust system (Item 9, Figure 2, not shown explicitly). '203 also teaches that this system is used to exhaust unwanted gas from the entire system (Column 7 Lines 22-29; there is no mention of valve 26 being closed so the system is evacuated all the way to the source). '203 also teaches that this bypass

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system is designed to prevent mingling of process gasses which may undergo unwanted side reactions (Column 8 Lines 48-63).

iv) Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to have modified the apparatus as taught by modifying the apparatus of '943 to include a bypass mechanism connected to the exhaust system as taught in '203 because the bypass mechanism prevents unwanted mixing of gases and prevents reaction of gases to form unwanted products..

v) Furthermore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to have performed the method of '991 using the apparatus of '943 as modified by the bypass mechanism of '203 because '991 teaches a method of depositing a silicon nitride film, '943 teaches an apparatus capable of depositing a silicon nitride film, and the apparatus of '943 advantageously improves the uniformity of the deposited film and therefore the quality of the final product.

vi) With specific regard to Claim 2, which includes all the limitations of Claim 1 above, '943 teaches:

(1) Wherein after removing said batch of wafers, the process further comprises flowing cleaning gas into said tube (Column 5 Line 33 – Column 6 Line 38).

vii) With specific regard to Claim 3, which includes all the limitations of Claim 2 above, '943 teaches:

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(1) Wherein said cleaning gas comprises ClF_3 (Column 8 Lines 1-7).

viii) With specific regard to Claim 4, which includes all the limitations of Claim 2 above, '943 teaches:

(1) Wherein said cleaning gas comprises NF_3 (Column 8 Lines 1-7).

ix) With specific regard to Claim 5, which includes all the limitations of Claim 1 above, '203 teaches:

(1) Wherein by opening said initially interrupted bypass line upon completion of said silicon nitride deposition process, said BTBAS remaining in said BTBAS supply piping line is evacuated through said bypass line without entering said tubular furnace, thereby eliminating particle problems (Column 8, Lines 48-63, taught with different gas but on identical principle).

x) With specific regard to Claim 6, which includes all the limitations of Claim 1 above, '991 teaches:

(1) Wherein said nitrogen-containing gas comprises ammonia gas (Column 8 Line 57 – Column 9 Line 7).

xi) With specific regard to Claim 7, which includes all the limitations of Claim 1 above, '991 teaches:

(1) Wherein silicon nitride deposition process is carried out at a temperature of between 450-600°C (Column 9 Lines 1-7 explicitly teaches 600°C).

xii) With specific regard to Claim 8, which includes all the limitations of Claim 1 above, '991 teaches:

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(1) Wherein said BTBAS is flowed into said tube at a flow rate of about 25-500 sccm (Column 8 Lines 60-63 explicitly teach 60 sccm of BTBAS).

xiii) With specific regard to Claim 9, which includes all the limitations of Claim 1 above, '991 teaches:

(1) wherein said nitrogen-containing gas is flowed into said tube at a flow rate of about 50-1000 sccm (Column 8 Lines 64-65 teach a flow of 200 sccm of nitrogen containing gases; as detailed in Figure 2, the composition of the mixture was allowed to vary).

Conclusion

5) The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. U.S. Patents 6,153,261 and 6,936,548, as well as U.S. PGPub 2004/0096582, teach similar methods of CVD using aminated silane compounds. U.S. PGPubs 2001/0000476 and 2005/0255712 discuss flow rates of similar process gases in CVD processes. U.S. Patent 5,540,777 discusses a similar bypass process.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael G. Miller whose telephone number is (571) 270-1861. The examiner can normally be reached on MTWR 7:30 - 5:00, F 7:30 - 4:00, Eastern Time.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Cleveland can be reached on (571) 272-1418. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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MICHAEL B. CLEVELAND
SUPERVISORY PATENT EXAMINER